

Correlation between Mathematical Literacy Ability and Pedagogic Competence of State Vocational High School Mathematics Teachers in Manado City

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Abstract: *This article contains a survey research report with a correlative approach between mathematical literacy skills and the pedagogic competence of vocational mathematics teachers in Manado city, North Sulawesi province. Correlation analysis was carried out on three categories of mathematical literacy abilities which include spatial literacy skills, numerical literacy skills and data literacy abilities, each with pedagogic competence. In addition, a correlation analysis was also carried out between the three categories of literacy abilities together with pedagogic competence. Data were analyzed by testing 4 (four) statistical hypotheses by applying multiple regression and correlation analysis. The results showed that (1) there was a positive influence of spatial literacy on the pedagogic competence of mathematics teachers, (2) there was a positive effect of numerical literacy on teachers' pedagogic competence, (3) there was a positive influence of data literacy on the pedagogic competence of mathematics teachers, there was a positive influence of spatial literacy. , (4) there is a positive influence of spatial, numerical and data literacy which together affect the pedagogic competence of mathematics teachers. Thus, it can be concluded that the mathematical literacy skills of vocational mathematics teachers in the city of Manado, North Sulawesi province have a positive effect on their pedagogic abilities.*

Keywords: Survey research, Correlative approach, Literacy ability, Spatial literacy, Numerical literacy, Data literacy, Pedagogic competence.

1. Preliminary

Pangesti Widarti, et al (2016) for that literacy plays an important role in this era of cultural globalization. Because that is what causes the development of the notion of literacy, the concept of teaching literacy is defined as the ability to read and write. A person can be called literate if he already has to be used in every activity that requires an effective literacy function in society and the knowledge he achieves by reading, writing, and writing knowledge that allows him to use it for himself. Romdhini (2013), states that literacy is a social event that involves certain skills, which are needed to convey and obtain information in written form. Literacy and numeracy is more than just reading, writing and arithmetic. Literacy includes the ability to read, understand and critically appreciate various forms of communication, both oral, printed text, broadcasting media (radio, TV) and digital media. While numeracy includes the ability to use mathematical understanding and skills to solve problems and meet the demands of everyday life in a complex social environment. To have this ability, every student needs to have the ability to think and communicate quantitatively (with number symbols), interpret data, have spatial awareness, understand patterns and sequences, recognize situations where mathematical reasoning can be applied in solving problems. Improving students' numeracy skills must be fully supported both from the school environment, family and community. In line with that, Iriantara (2009), explained that now literacy is not only related to the ability to read and write texts, because now "text" has expanded its meaning to include "text" in the form of visual, audiovisual and computerized dimensions. in the "text" together appear cognitive, affective, and intuitive elements.

The 2013 curriculum promises the birth of the nation's next generation who are productive, creative, innovative, and have character. With creativity, the nation's children are able to innovate productively to answer the challenges of an increasingly complex and complex future (Mulyasa, 2015). A person in education is equipped with various sciences, one of which is mathematics. The field of mathematics studies is one component of basic education in the fields of teaching. This field of study of mathematics education is needed for the calculation process and thinking process that is needed by people in solving various problems (Susanto, 2013). The problems studied in mathematics learning are generally presented in the form of problems in the form of problem solving, so there is a need for mathematical problem solving abilities. According to Robyanto and Harmini (2017), mathematical problem solving is a process in which a person is faced with mathematical concepts, skills and processes to solve mathematical problems, this requires the design and application of a series of steps to achieve goals in accordance with the given situation.

The lack of mathematical literacy skills makes students' abilities in creativity, reasoning and argument not developed so that it is difficult to solve mathematical problems in everyday life. From the results of the PISA (The Program for International Student Assessment (PISA) study) the quality of our education is still at a very worrying rating. The ranking of Indonesian students continues to decline from year to year. Based on the latest data released, Tuesday 3 December 2019, reading scores (literacy) Indonesia is ranked 72 out of 77 countries, then math scores (numbers) are ranked 72 out of 78 countries, and science scores are ranked 70 out of 78 countries (OECD, 2019). The lack of

mathematical literacy skills makes students' abilities in creativity, reasoning and argument not developed so that it is difficult to solve mathematical problems in everyday life. From the results of the PISA (The Program for International Student Assessment (PISA) study) the quality of our education is still at a very worrying rating. The ranking of Indonesian students continues to decline from year to year. Based on the latest data released, Tuesday 3 December 2019, reading scores (literacy) Indonesia is ranked 72 out of 77 countries, then math scores (numbers) are ranked 72 out of 78 countries, and science scores are ranked 70 out of 78 countries (OECD, 2019).

Mathematics is related to ideas, ideas, rules, and relationships that are arranged logically, so someone who studies mathematics must achieve understanding in order to feel the benefits in everyday life. Understanding is the process of knowledge possessed or in the person. Heibert and Carpenter (2006) stated that understanding mathematics requires a process to correctly place the information or knowledge being studied into the internal network of knowledge representations that have been previously possessed in the cognitive structure of students. To make students learn mathematics with understanding, teachers should plan and implement mathematics learning that involves active students in learning, both mentally, physically, and socially. The teacher's ability to plan and implement learning in accordance with the intellectual development of students is crucial for whether or not a concept is learned and understood by students. So it can be concluded that the understanding of mathematics is the level of ability that expects the testee to be able to correctly place knowledge about the meaning or concept, skills and problem solving of mathematics. Mathematical literacy is an individual's ability to apply, formulate and describe mathematics in various situations, including the ability to reason mathematically and use concepts, procedures, and facts to describe, explain or predict phenomena/events. Mathematical literacy helps someone to understand the role or use of mathematics in everyday life while using it to make the right decisions as citizens who build, care and think. Formally the definition of mathematical literacy in the framework of the 2012 Mathematical PISA presented by OECD and Stacey has at least three main things that become the main ideas of the concept of mathematical literacy, namely: (1) The ability to formulate, apply, and interpret mathematics in various contexts, hereinafter referred to as the process of mathematics, (2) Involvement of mathematical reasoning and the use of mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena, (3) The benefits of mathematical literacy skills are that it can help someone in applying mathematics to everyday life as a form of constructive and reflective community engagement. There are 7 (seven) indicators of mathematical literacy skills used in the assessment of the mathematical process in PISA (OECD, 2019), namely: (1) Communication (communication), (2) Mathematizing (mathematizing), (3) Representation (representation), (4) Reasoning and argument (reasoning and arguments), (5) Devising strategies for solving problems, (6) Using symbolic, formal and technical language and operations (use of symbols, operations, and formal language), and (7) Using mathematical tools (use of mathematical tools).

Mulyasa (2013), in the Law of the Republic of Indonesia Number 14 of 2005 concerning Teachers and Lecturers, it is explained that: "competence is a set of knowledge, skills, and behaviors that must be possessed, internalized, and mastered by teachers or lecturers in carrying out professional duties". In Law on Teachers and Lecturers No.14/2005 Article 10 paragraph 1 and Government Regulation No.19/2005 Article 28 paragraph 3 it is stated that teacher competence includes pedagogic competence, personality competence, social competence and professional competence. Wahyudi (2012) explains that pedagogic competence is the ability of a teacher to manage the learning process of students. In addition, pedagogic abilities are also shown in helping, guiding and leading students. Indicators of pedagogic ability include: (1) Mastering the characteristics of students from the physical, moral, social, cultural, emotional, and intellectual aspects, (2) Mastering learning theory and educational learning principles, (3) Developing curriculum related to subjects the lessons/fields of development that are taught, (4) Organizing educational learning, (5) Utilizing information and communication technology for learning purposes, (6) Facilitating the development of the potential of students to actualize their various potentials, (6) Communicating effectively, empathically , and polite with students, (7) Conducting assessments and evaluations for the benefit of learning, and (8) Take reflective actions to improve the quality of learning.

There are 4 (four) hypotheses tested, namely (1) correlation between numeric literacy ability and teacher competence, (2) correlation between spatial literacy ability and teacher competence, (3) correlation between data literacy ability and teacher competence, and (4) correlation between numeric literacy skills, spatial literacy skills and data literacy skills together with the competence of vocational mathematics teachers in Manado.

2. Research Procedure

The method that will be used in this research is a survey with a correlation approach (Singarimbun, 1989:4; Faisal, and Waseso, 1982:293). The data collection was carried out at the Manado City Public Vocational School from January 2022 to May 2022. The population is all characteristics related to the three variables in the population of Mathematics teachers at State Vocational Schools in Manado City totaling 43 teachers. Based on the Slovin sampling technique (Riduwan, 2009: 95), a sample of 39 people was determined. Researchers set pedagogic competence as variable Y, and mathematical literacy ability as variable X which is divided into 3 (three) categories. The category in question is spatial literacy ability called variable X1, numeric literacy ability is called variable X2, and data literacy ability is called variable X3. The correlation research paradigm in question is shown in Figure 1.

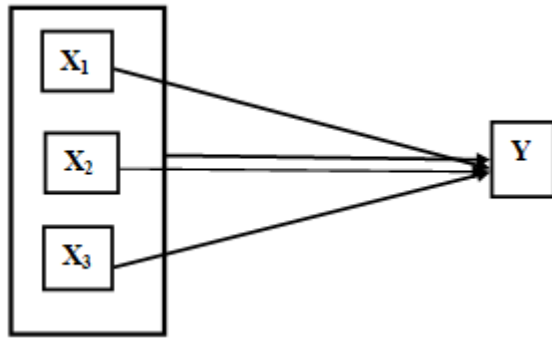


Figure 1: Correlative research paradigm used in this study

The instrument used to collect information about the condition of each variable, namely spatial literacy, numeric literacy, and data literacy and pedagogic competence is a questionnaire. The data collected will be analyzed using the following statistics: (1) a description of the data consisting of the frequency distribution and histogram, (2) testing the

analysis prerequisites, namely testing the analysis requirements, namely testing data normality and regression linearity, and (3) hypothesis testing is done by using regression analysis and multiple correlation.

3. Results and Discussion

The research instrument in the form of a questionnaire for spatial literacy variables was compiled to produce 19 valid statements out of 20 items that were compiled. Thus, theoretically the score of respondents' answers is in the range between 19 - 95. Based on the research data, it is known that the empirical score is in the range of 40 - 95. The making of the frequency distribution is done by dividing the distribution class into seven classes whose presentation can be seen in Figure 2.

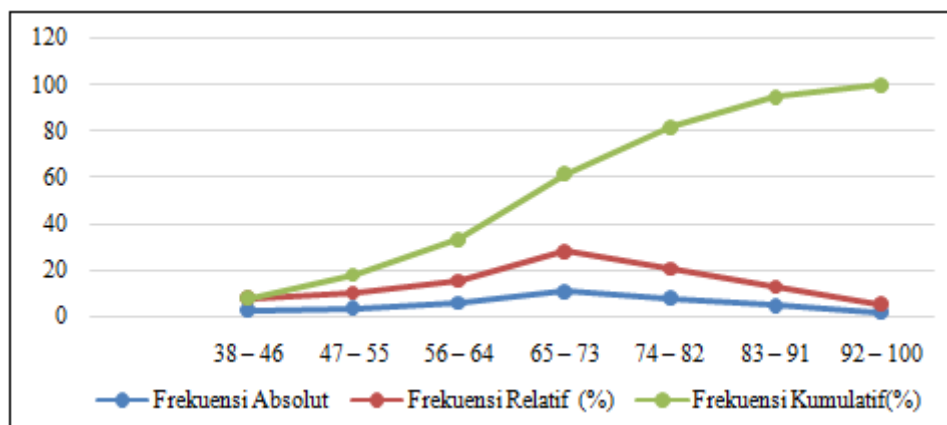


Figure 2: Frequency Distribution of Spatial Literacy Variable Data (X_1)

Based on Figure 2, it can be assumed that the distribution of spatial literacy ability variable data according to absolute frequency or according to relative frequency leads to the form of a normal distribution graph.

The Numerical Literacy variable questionnaire instrument was compiled to produce 19 items that were valid statements from the 19 items that were compiled. Thus,

theoretically the score of respondents' answers is in the range between 19 - 95. Based on the research data, it is known that the empirical score is in the range of 40 - 94. The frequency distribution is made by dividing the distribution class into seven classes whose presentation can be seen in Figure 3.

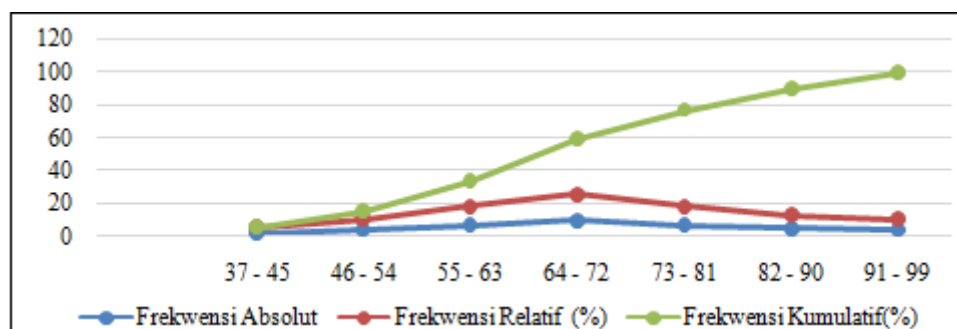


Figure 3: Frequency Distribution of Numerical Literacy Variable Data (X_2)

Based on Figure 3, it can be assumed that the distribution of numerical literacy ability variable data according to absolute frequency or according to relative frequency leads to the form of a normal distribution graph.

The questionnaire instrument for the Data Literacy variable was compiled to produce 18 valid statement items from the 18 items compiled. Theoretically the score of respondents' answers is in the range between 18 - 90. Based on the research data, it is known that the empirical score is in the range of 38 - 90. The frequency distribution is made by

dividing the distribution class into seven classes whose presentation can be seen in Figure 4.

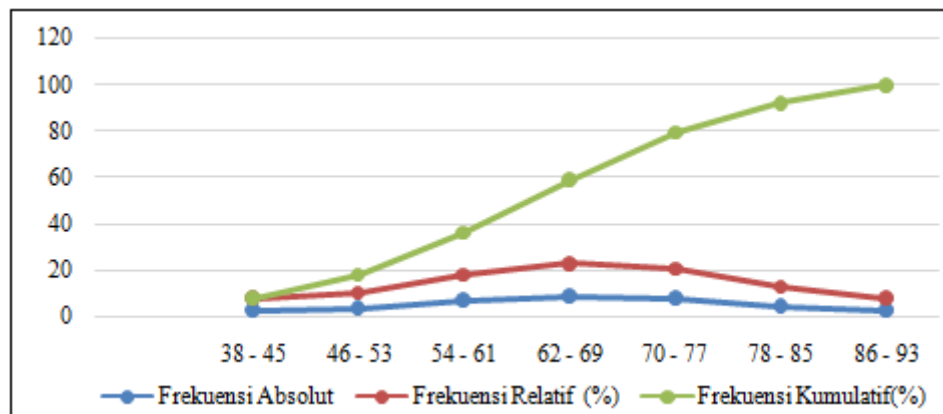


Figure 4: Data Frequency Distribution of Data Literacy Variables (X_3)

Based on Figure 4, it can be assumed that the data distribution of the data literacy ability variable according to absolute frequency or according to relative frequency leads to the form of a normal distribution graph. Next, the analysis prerequisite test was conducted, namely the analysis requirements test, namely the data normality test and regression linearity testing. The results of the Liliefors test on the data normality of the mathematics teacher pedagogic competence variable, obtained L count of 0.09 while the L_{α} table for $n = 39$ at $\alpha = 0.05$ was 0.12. Based on the guidelines for testing hypotheses about the normality of the data, from these results obtained $L_{count} < L_{table}$, so reject H_a , which means that the data on the pedagogic competence variable data for mathematics teachers, comes from a population that is normally distributed. The results of the Liliefors test regarding the normality of the data for the spatial literacy variable of mathematics teachers, obtained L count of 0.07 while the L_{α} table for $n = 39$ at $\alpha = 0.05$ was 0.12. Based on the guidelines for testing the hypothesis about the normality of the data, then from these results obtained $L_{count} < L_{table}$, so reject H_a , which means the data on the spatial literacy variable of mathematics teachers, comes from a population that is normally distributed. The results of the Liliefors test regarding the normality of the numeric literacy variable data for mathematics teachers, obtained Lcount of 0.07 while L_{α} -table for $n = 39$ at $\alpha = 0.05$ was 0.12. Based on the guidelines for testing hypotheses about the normality of the data, then from these results obtained $L_{count} < L_{table}$, so reject H_a , which means the data on the numeric literacy variable for mathematics teachers, comes from a population that is normally distributed. The results of the Liliefors test on the normality of the data literacy variable for mathematics teachers, obtained Lcount of 0.08 while the L_{α} -table for $n = 39$ at $\alpha = 0.05$ was 0.12. Based on the guidelines for testing hypotheses about the normality of the data, from these results obtained $L_{count} < L_{table}$, so reject H_a , which means the data literacy variable data for mathematics teachers, comes from a population that is normally distributed. The results of the analysis of the significance of the regression coefficients show that the spatial literacy regression equation for the pedagogic competence of mathematics teachers is significant. The results of the significance analysis of the regression coefficients show that the numerical literacy regression equation on the pedagogic competence of mathematics teachers is significant. The results of the

significance analysis of the regression coefficients show that the data literacy regression equation for the pedagogic competence of mathematics teachers is significant. The results of the analysis of the significance of the regression coefficients show that the regression equation for spatial literacy, numerical literacy and data literacy on the pedagogic competence of mathematics teachers is significant.

Hypothesis testing is done by using multiple correlation and regression analysis. The first hypothesis to be tested is that there is an effect of spatial literacy on the pedagogic competence of mathematics teachers. Based on the results of data analysis, it can be seen that the hypothesis which states that spatial literacy has a significant positive effect on the pedagogic competence of mathematics teachers at State Vocational Schools in Manado City is acceptable. The second hypothesis in this study is that there is an effect of numerical literacy on the pedagogic competence of mathematics teachers. Based on the results of data analysis, it can be seen that the hypothesis which states that numerical literacy has a significant positive effect on the pedagogic competence of mathematics teachers at State Vocational Schools in Manado City, can be accepted. The hypothesis proposed in this study is that there is an effect of data literacy on the pedagogic competence of mathematics teachers. Based on the results of data analysis, it can be seen that the hypothesis that data literacy has a significant positive effect on the pedagogic competence of mathematics teachers at State Vocational Schools in Manado City is acceptable. The final hypothesis proposed in this study is that there is an effect of spatial literacy, numerical literacy and data literacy together on the pedagogic competence of mathematics teachers. The results of the analysis show that there is a positive influence of spatial literacy, numerical literacy and data literacy together on the pedagogic competence of mathematics teachers, meaning that changes in the increase in changes in spatial literacy, numerical literacy, and data literacy together cause an increase in the pedagogic competence of mathematics teachers.

4. Conclusions and Suggestions

Based on the discussion and research results, it can be concluded as follows: (1) The spatial literacy ability of SMK

mathematics teachers in Manado City, has a positive effect on their pedagogic competence, (2) The numerical literacy ability of SMK mathematics teachers in Manado City, has a positive effect on pedagogic competence them, (3). The data literacy ability of SMK mathematics teachers in Manado City has a positive effect on their pedagogic competence, and (4) The joints patial literacy, numerical literacy and data literacy abilities of SMK mathematics teachers in Manado City have a positive effect on their pedagogic competence. Based on the results of the study it is recommended, (1) To improve the pedagogic competence of mathematics teachers, the ability to master spatial literacy should be improved, (2) To improve the pedagogic competence of mathematics teachers, the ability to master numerical literacy should be further improved, (3) To improve the pedagogic competence of mathematics teachers, the ability to master data literacy should be further improved, (4) Should improve the pedagogic competence of mathematics teachers by mastering spatial literacy, numeric literacy and data literacy together.

5. Acknowledgement

The researcher expresses his highest gratitude to the Manado State University, especially the Postgraduate Program which has provided the opportunity for researchers as students to attend lectures in the Master of Mathematics Education program.

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